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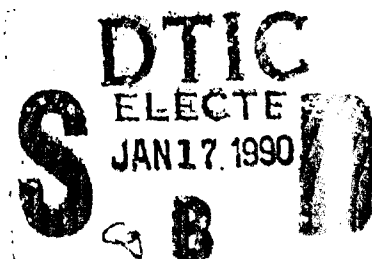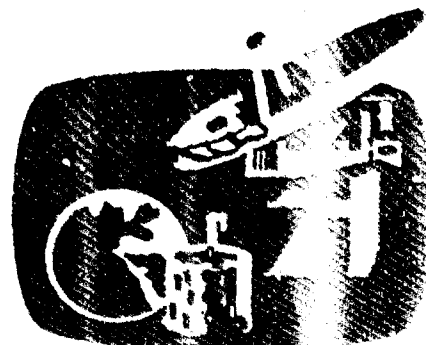COMMUNICATIONS, AND COMPUTER SCIENCES
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TECHNOLOGY ASSESSMENT OF DECISION SUPPORT

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An assessement of the current, near-term (1995), and long-term (2010) trends in Decision Support is given. Decision Support is defined as including Decision Support Systems, Executive Support Systems, and Group Decision Support Systems as well as the supporting technology of Expert Systems.

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This research was performed as an in-house project at the Army Institute for Research in Management Information, Communications, and Computer Sciences (AIRMICS), the RDTE organization of the Army's Information Systems Engineering Command (ISEC). This effort was performed under the AIRMICS Technology Insertion Program to support the Army's Information Systems Command (ISC) in the development of a report entitled "Long Range Planning Guidance – Objective Configuration." An initial meeting was held in early December in Atlanta to coordinate the task. Twenty-six topics were selected for consideration, with AIRMICS agreeing to conduct technology assessments on fifteen of the topics. Planning Research Corporation (PRC) was assigned responsibility for conducting the assessments and consolidating all the assessments for use in the planning document. In a two-week period, AIRMICS completed the assessments and provided the results to ISC-DCSPLANS and ISEC-SID.This research report is not to be construed as an official Army position, unless so designated by other authorized documents. Material included herein is approved for public release, distribution unlimited. Not protected by copyright laws.

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TECHNOLOGY ASSESSMENT
OF DECISION SUPPORT

I.   Historical Review

Since the beginning of the "computer age", one of the primary goals of computer advocates has been to increase the efficiency and effectiveness of everyone in the organization. The earliest attempts to provide computer support emphasized the "improve efficiency" aspect of this goal. Thus, early computer applications tended to support the more structured activities within the organization such as payroll, accounts payable, word processing and general ledger. In the 1950's and 1960's, computer advocates began to realize that for computers to have any real impact on the organization, they would need to attack the effectiveness aspect of the above goal. We then saw the proliferation of Management Information Systems (MIS) which tended toward the philosophy that the more data provided to a manager, the more effective he or she would be in making a decision. Although this point of view can still be found today, computer advocates have come to realize the importance of supplying real information rather than just lots of data. Thus was born the idea of decision support, systems designed to support, through data and analysis, the decision making capabilities of the manager.

Decision Support Systems (DSS) have now been around since the early 1970's and have evolved to the point where they are indispensable tools in many organizations. However, DSSs basically support individual, mid-level managers and analysts. Because of this evolution toward individuals and mid-level management, two new areas of decision support are beginning to emerge. One of these is the concept of an Executive Information System (EIS), which attempts to support the higher levels of the organization. Though EIS

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have also followed the DSS path of individual support, there are differences which we will discuss later in this paper. Also, it is clear that for EIS to better fulfill the goal of increased effectiveness of the organization, the future path of EIS will have to evolve toward providing support linking the executive to his subordinates and peers. The other offshoot of DSS is the area of Group Decision Support Systems (GDSS). The emphasis on groups means that a new, different set of issues must be resolved in order for technology to be applied to aid group processes. These issues are complex because they involve the interactions of groups working toward a common goal.

Another area related to decision support is Artificial Intelligence (AI). The main area of AI related to decision support is that of Expert Systems (ES). The basic idea of an Expert System is to capture the knowledge of an expert in some field into a knowledge base (analogous to a data base) and then to use this knowledge together with an inference engine (analogous to an algorithm) to allow a non-expert to function at a higher level. This approach provides another method of support quite different from DSS, EIS and GDSS. It is not the purpose of this paper to go into specific details about AI/ES, since these details are beyond the scope of this paper. The interest in ES is in how this particular technology can be used to enhance the capabilities of the other three area of decision support.

Decision Support can thus be divided into three categories: Individual Support, Executive Support, and Group Support; with Expert Systems as a technology supporting all three categories. These categories represent different orientations on where the support is provided: the individual, the executive, or the group. Of these categories, Individual Support refers to what is traditionally called Decision Support Systems (DSS). As such, Individual

Support has received the most attention both in research and commercial products. However, some of the concepts and products developed under the DSS label are applicable to the other two categories and thus we will often refer to DSS in a generic sense and use this term to mean all three. When specifics require a distinction we will be careful to point out which of the three orientations is being used.

For the purposes of this paper, Decision Support will be defined as "... a computer-based system used to support the needs of managers for data or analysis" (see 4). The key aspects of this definition are support and managers. This definition has the advantages of being simple to understand and also to be applicable to the three orientations mentioned above, depending on whether we interpret the word "manager" to mean an individual manager, an executive, or a group of managers. The disadvantage of this definition is that it may be too broad (MIS supports managers). Furthermore, most definitions of DSS include both data and analysis. We have chosen a less restrictive definition since most current software which claims to be DSS support primarily either one or the other.

Distinctions can be made among these three categories by looking at the intended audiences. Individual Support, representing traditional DSS, supports single users at the mid-management level and as such have tended to be functionally oriented. There are many examples of DSS designed to support the financial, logistic, or personnel functions. EIS, on the other hand, are geared toward upper level managers and tend to look less at particular functions and more at monitoring of the entire organization. Another distinction between these two categories is that DSS have been oriented to analysis and the "what if" type of question and EIS have been oriented toward

the current situation and the "what is" type of question. Group Support differs from both of the other categories in it emphasis on group interactions. Group Support recognizes that few important decisions are made in isolation and hence focuses on support for group interaction and dynamics. Thus, Group Support keys on tools to support this interaction such as group brainstorming, idea-sharing, Decision Rooms, and group facilitators.

II. Currently Available

A.   DECISION SUPPORT SYSTEMS/INDIVIDUAL SUPPORT SYSTEMS. Traditionally, DSS have tended to support mid-level managers focusing on a single functional area. DSS have evolved to the point where a DSS is viewed as an integrated set of capabilities that support all of a manager's data and analysis needs. Basically, this "DSS Generator" capability gives the manager the ability to access data and perform data manipulation functions (modeling). Ideally, a DSS provides a manager with a set of tools to better understand and manage his or her internal and external environment. Typical functions include command and data query, report writing, and color graphics facilities. These capabilities enable the manager to access data and perform modeling of the functional area.

Figure 1 represents an ideal DSS Generator. However, most DSS software falls into one of two categories. The "friendly" Data Base Management System (DBMS) provides the manager the facility for managing and accessing large bases of data, creating reports and graphs, and performing limited data analysis. The other class of DSS – Spreadsheet Modeling Systems – gives the manager the ability to define explicit models of several variables and to calculate the results of the model over time. These modeling and DBMS DSS
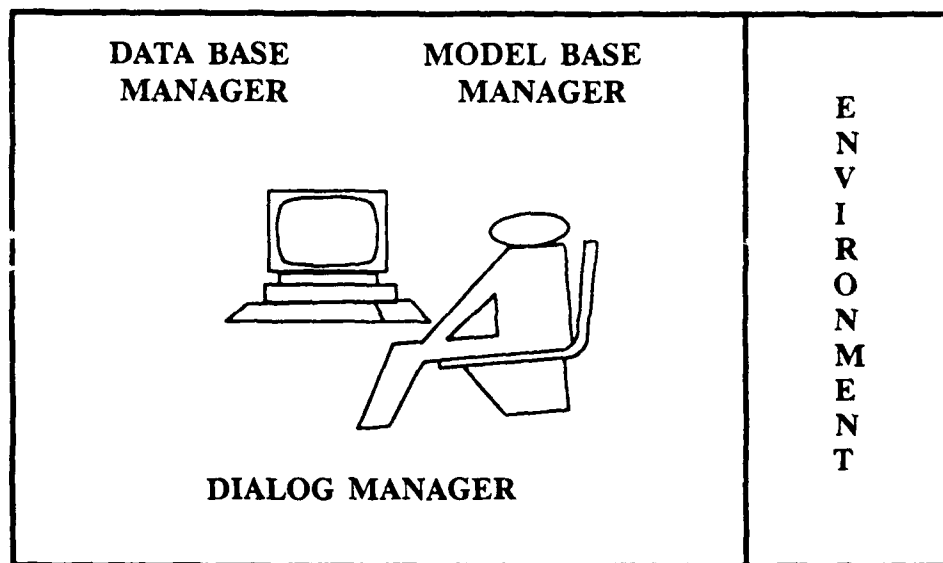
Figure 1

reside almost exclusively on mainframe and mini-computer systems. Also, the two types of DSS are often not integrated or else integration is poorly implemented. The result of this division is that DSS tend to be independent systems with their own data, reports, and models separate from other DSS. What this implies is that individuals and applications do not share a common conceptualization of the organization.

Fortunately, the trend in DSS is more toward an organizational support system whereby data and models are shared throughout the organization. The challenge is to provide a common and integrated DSS across a distributed hardware environment (micro, mini, and mainframe).

B. EXECUTIVE INFORMATION SYSTEMS. The term Executive Information System (EIS) has been around since about 1981, although the idea and concept are much older, tracing its roots back to Management Information Systems through Decision Support Systems. Much of the early writing on EIS reflect

this background, especially the ties to DSS. Because of the relatively new nature of EIS, there is still much confusion about what an EIS is and how EISs impact the organization. Also, in the literature, several other names are used for the EIS concept including Executive Support Systems and Executive Decision Support Systems.

The early writings on EIS tended to emphasize the data analysis aspects of EIS often to the neglect of the use of EIS for communications, electronic mail, and monitoring. In fact, it is because of this data analysis emphasis that it is often difficult to distinguish between EIS and DSS. EIS has often been viewed as an extension of the data-driven DSS with the only difference being that the support is for an executive. This early emphasis on data ignored the potential for supporting the executive in other areas. A typical EIS menu is shown in figure 2.
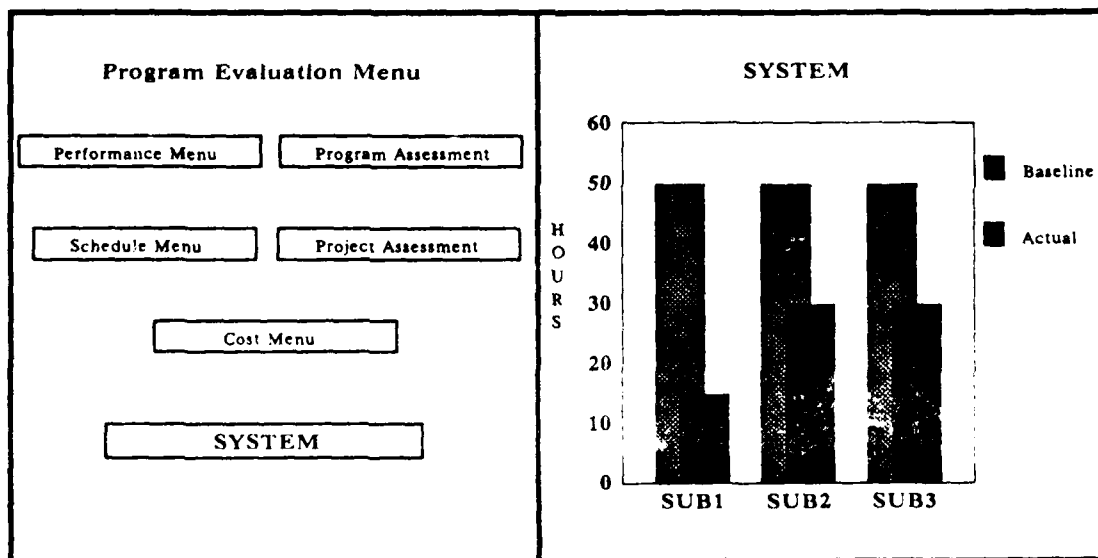

Figure 2

One way to examine the nature of EIS is by the typical functions they perform. In a study of 30 large corporations, Rockart and DeLong (see 3) observed three types of EIS capabilities:

Communications. The typical pattern found was terminal-based access to electronic mail and computer conferencing. They report that this use of EIS has emerged as a major factor in executive support.

Status Analysis. This support is usually supplied through a set of pre-formatted and pre-determined reports. Although the executive can view the information in any order he or she chooses, there is usually little or no ability to vary the reports that can be seen. This capability is used to monitor the organization and is a key element of most EIS. This capability provides the executive with a "what is" look at the organization.

Query and Analysis. This capability allows the executive to perform data and ad-hoc analyses. However, this capability is rare at the executive level and falls below the use of communications and status access for executive support.

Another perspective can be gained by categorizing EIS along the lines of the managerial purpose for the system. Rockart and Delong identify three such managerial purposes from least to most important:

Support for office functions to improve the executive's efficiency and effectiveness.

Improve the support of the organization's planning and control processes.

Clarification and enhancement of the executive's mental model of the organization's environment.

One of the most commonly held beliefs by executives (and their staffs) is that there are more tasks to be performed than time permits. Thus, improved efficiency is often seen as a major factor in trying to provide support to the

executive. This leads to those office support functions which tend to foster efficiency in day-to-day office tasks. According to Rockart and DeLong, there are three categories of office support applications used in EIS:

Communications-based applications: electronic mail, news and word processing.

Data and analysis tools: spreadsheets.

Organizing tools: electronic calendars, automated rolodexes, and tickler files.

The advantage of these types of tools to executives (even if not used directly) is to decrease the amount of time spent on these tasks. However, except for electronic mail and news, these EIS applications are of limited value to most executives.

Today, the most important managerial purpose for EIS is to improve support for the organization's planning and control process. Support for this function has a significant impact, often affecting the focus of the organization. This use of EIS focuses on planning -- the process of making short- and medium-term goals -- and control -- the process of evaluating the organization's progress toward these goals. Rockart and Delong report on six ways that EIS improve the planning and control process:

Improve existing reporting systems.

Redesign of management reporting systems to focus on critical success factors.

Change the planning and forecasting processes.

Perform ad-hoc analysis using customized information bases.

Enhancement of personal communication links enabling executives to better monitor critical activities.

Improve program management capabilities in project-oriented organizations.

The six categories represent what is being done by EIS in planning and control. Rockart and Delong also list five reasons why EIS have an impact on this process:

Allows the executive to think through what is important to the organization.

Redirects this process from an historical process to a forward-looking process.

Dynamically revise the reporting process.

Expand operational monitoring and coordination and hands-on direction of the organization's activities.

Improve the management of data in the organization.

Although the most significant application of EIS is currently support for the planning and control process, enhancement of the executive's mental models of the organization may prove to be of greater importance in the long run. Whether consciously or unconsciously, executives use models --some explicit, but more often implicit (mental) -- to aid them in their understanding of the organization. These mental models and their importance to the executive can be seen through comments like "I need to improve my understanding of the

organization" or "Scanning the current status of the company enables the executive to see things that a less experienced person would not." This implies that EIS have the potential to impact the organization by enhancing these mental models of executives. Rockart and Delong identify six attributes that an EIS should have in order to provide this enhancement:

Improved access to external data.

Ability to combine data from multiple sources.

Data presented in more meaningful formats.

Improved analytic and modeling capabilities.

Ability to surface and test assumptions about the organization.

Off-hours data access.

The impact of EIS on the executive and the organization are often subtle and difficult to understand; however, EIS do have an impact. EIS alone are not the cause of change in the organization, but rather they often act as a facilitator of rational management decisions. Moreover, there are at least four identifiable managerial objectives upon which EIS have an impact.

Reduction in staff and middle management.

Increased span of control by the executive.

Role changes in the organization.

Organizational changes.

Clearly, the first two objectives, and to a lesser degree the last two, are occurring in most large organizations. The EIS are not causing these changes

to occur; however, EIS technology serves to move the organization toward these objectives.

C.   GROUP DECISION SUPPORT SYSTEMS. GDSS is the newest type of decision support beginning to emerge in tne late 1980's. Group processes and support are not new, nor is the use of automation to support groups. The "new" aspect of GDSS is the fact that automation technology is changing rapidly and it is only now that the types of group support envisioned earlier are beginning to become possible. Group activities are supported by the beliefs that such activities are economically necessary, efficient as a means of solving problems, and ultimately beneficial to the organization. The challenge to technology is to find ways to support these beliefs. The technology problems are solvable, as can be seen by the emergence of telecommunications and other technologies. The more difficult problems to be faced revolve around the nature of group activities. These problems pose significant challenges to researcher to clearly define a "vision" that can be supported through technology.

As is the case with DSS and EIS, the growth of GDSS has (and will continue to) paralleled the growth of associated technologies such as communications, teleconferencing, electronic mail and the development of the micro-computer. The main goal of a GDSS is to use this technology to facilitate the tasks of group decision making within the broader context of cooperative work. It should be noted that currently most comprehensive GDSS are found only at major universities; the use of GDSS technology has not filtered down into extensive use in corporations and government. Note that this does not mean that corporations and government do not use some of these technologies. Rather, some of these organizations do use some of the GDSS technologies but

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not to the extent that is found in university research settings. The reasons for this state include the relatively new nature of GDSS and the reluctance of industry and government to try untested technology. This is more the function of university research teams. Thus, most of what can be said about GDSS comes from university research.

An idealized model of a GDSS can be thought of as being comprised of four elements: (1) hardware, (2) software, (3) organizationware, and (4) people. The idealized scenario for a GDSS is of a group of decision makers with access to a computer, viewing screens, data bases, and decision models, all working toward the solution of an important organizational problem with the aid of a group facilitator. The hardware includes conference facilities, computers, telecommunications, audio-visual equipment, display boards, and more. The software component is used to support general information processing, decision modeling, and communications. These software packages include word processors, stakeholder analysis, brainstorming, Delphi techniques, utility and probability assessment, and nominal ranking. The integrated use of software to support group processes is the key distinquishing technological feature of GDSS. Organizationware refers to the organizational data, group processes, and management procedures for collaborative work used by the GDSS package. The final ingredient of the GDSS package is the people, which includes the participating decision makers as well as the support staff. One of the unique aspect of the GDSS is the use of a facilitator. The role of the facilitator is to support the group in the use of the technology and to guide the group toward the resolution of the problem. One type of GDSS – the Decision Conference – is depicted in figure 3.

Kraemer and King (see 2) identify five types of GDSS:

Electronic Boardrooms (computer and audio-visual support).

Teleconferencing Facilities (computer and communication support).

Group Networks (computer network and interactive conferencing).

Decision Conference (computer and decision models support).

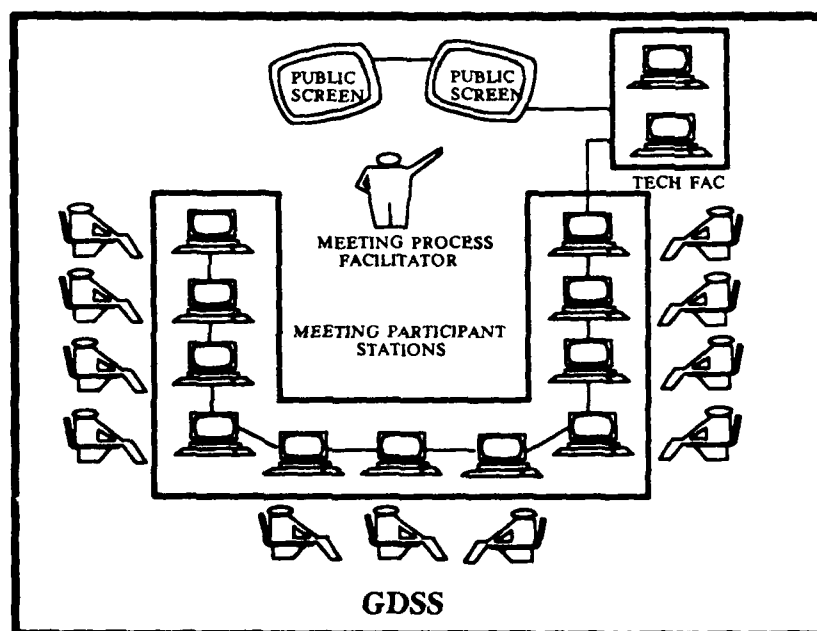Collaboration Laboratory (computer and collaboration tools).

Figure 3

There are hundreds of electronic boardrooms each more or less custom built for specific organizations with the primary focus on audio-visual support. Teleconferencing facilities are somewhat rarer with only a few private and even less public facilities. Electronic boardrooms and telconferencing facilities represent the low end of what can be supplied under the GDSS model.

Decision conferences are the first type of GDSS that begin to approach the model, and almost all of these are housed in universities and are used primarily for laboratory type research. In the better decision conference GDSS,

the facilities will include a conference room, large screen video projector, computer, video terminals, terminals for voting by participants, and a control terminal. The room may also contain breakout rooms that can be used by smaller groups assigned to handle smaller pieces of the problem. The software use by decision conferences includes: decision trees and influence models, multiattribute utility models, hierarchical evaluation, cost-benefit models, and spreadsheet models. The organizationware usually relates to meeting protocols regarding who participates, on what basis, with what voting rights, and with what consequences and commitments. The decision conferences almost always include a facilitator.

The collaborative lab focuses on computer support for face-to-face group work. The lab is more general in nature that the decision conference in that the lab is more interested in general group work as contrasted to the decision focus of the decision conference. Thus the lab is more interested in verbal and qualitative techniques which are more common forms used in group meetings. The facilities of the lab are similar to those of the decision conference, but the software support is different. One of the primary software tools is a group outlining tool that includes specific features to aid group collaboration.

Finally, group networks are an outgrowth of the limitations of teleconferencing. The group network is focused on small groups in dispersed locations. One of the key distinquishing feature of group networks is the participant's ability to access and manipulate group information. The software includes meeting schedulers, shared applications such as graphics, spreadsheets, and word processing, and calendars. Integrated group networks exist only in prototypes at universities.

III. 1995 (Near Term)

There are three major trends in software that promise to impact the near-term future of DSS in the organization:

DSS packages are becoming more comprehensive.

Electronic messaging capabilities are improving.

Expert System technology is being used to enhance DSS capabilities.

The first trend is an obvious one. DSS capabilities are becoming more integrated. DSS software vendors realize the need to provide an easy to use capability of integrating the corporate data and models for all decision makers to use. Also, this trend is being pursued from both sides; i.e. from the data base and the modeling perspective. The second trend is toward the use of communication functions to improve decision support (see also the discussion on EIS). This trend promises to extend decision support by providing image, voice, and video communications capabilities. This communications support will significantly expand the role of DSS in the functioning of the organization from mid-level managers up to the top-level executives.

The third trend in DSS software is toward the use of Expert Systems to improve the capabilities of the DSS technology. In the area of improved interface technology, Expert Systems will help provide more intelligent interfaces, systems that try to understand what the user is attempting to do. Expert Systems will enable DSS to expand from the routine use of quantitative data to the more qualitative data that is often more crucial to the needs of the manager. Expert Systems will also help to make modeling capabilities smarter, perhaps by teaching the user how to forecast or by extending the explanatory

side of traditional models. Finally, communication can be expanded through the use of Expert Systems by providing filtering and categorizing capabilities.

Just as DSS software is changing, so are the hardware platforms. It is now clear that DSS are migrating from the mainframe and mini-computer systems to the micro world. And, there are now sound reasons for this migration. With the advent of 386 machines, the PS/2 architecture, and the OS/2 operating system, we have enter into an era where micros now have enough power to run large DSS applications. In addition, micro computers are better suited to provide the ease of use that is now one of the cornerstones of DSS applications. Micros are better suited to this task because of the role of interactivity in ease of use. This migration to micros implies that the role of the mainframe and mini-computer in DSS applications will become that of a central data manager and manager of shared resources.

Because of these advances in micro technology, the trend for DSS software is toward an integrated micro and mainframe/mini architecture, with the micro playing the major role. What this will involve is the DSS application running in a distributed environment with a micro DBMS linked to a mainframe/mini DBMS. When the user or an application needs a piece of data, this data is retrieved from the appropriate source (either the micro or the mainframe/mini DBMS) in a completely transparent (to the user) manner. The user then has a unified logical view of his DSS as one system supporting his decision needs.

There are at least three distinct classes of software emerging that will impact on DSS: (1) distributed data management software, (2) micro interface manager coupled to the operating system, and (3) application software that works with the interface manager and the local DBMS. Distributed data management represents a difficult technical problem whose solution will come

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from large mainframe vendors with a major investment in data base technology. The importance of this development on DSS technology is in the area of supporting an active data link between the application running on the micro and the large data bases residing on the mainframes and minis. There are currently several interface managers available for micros, but clearly this market will eventually be dominated by the IBM Presentation Manager coupled to OS/2. The currently available 386 and PS/2 machines are of such power that a new generation of micro based software is emerging that will give the DSS end-user tremendous power over his environment.

Rockart and DeLong offer some thoughts on what the near-term future holds for EIS.

First, EIS is still new and as such is still groping for it's place in the organization. EIS will continue to grow and have a greater impact as other systems (such as MIS and DSS) continue to evolve. The second point about EIS is that EIS represent only one tool that executives use for support. EIS (and computer usage in general) will never satisfy all of the needs of the executive. The third point is the EIS will only affect a small group of executives in the near future. There are many reasons for this, perhaps the most significant being the nature of executives and their work. It is not easy to automate many of the executive's functions and many executives are reluctant to get directly involved with computers. Change is an evolutionary not a revolutionary process. Fourth, communications and planning and control will continue to be the primary use of EIS, because these are managerial "musts" at the top executive levels. The fifth point is that the biggest payoff for the future will be in enhancing the executive's understanding of the organization and it's environment. The last point is that the spread of EIS is inevitable,

because technology ultimately changes the way people work and executives must continue to seek ways to increase the ability of their organization to function in a changing environment.

Finally, the technology needed to support GDSS is available now and the cost/performance ratio is improving. The major roadblocks to the use of GDSS are technical problems, problems with the GDSS package, and incomplete understanding of the decision making process. Technical problems include communications, video display quality, graphics capability, and modeling and analysis software. Currently, there are no complete GDSS packages as defined earlier. All of the components exist today; and by 1995, we will see the integration of subsets of these components that will move toward more complete, comprehensive GDSS packages. Finally, the study of group decision making is a new field. The problems associated with group processes can and will be understood through the cooperation of universities with their GDSS experience, and corporations and government with their need to use technology to better run their organizations.

IV. 2010 (Long Term)

The long term problems associated with Decision Support can be summarized as improved technology and better understanding of how organizations, and individuals within the organization, function. The recent history of technology clearly indicates that the technological problems can and will be solved. Better, faster, cheaper technology will become available. The more difficult challenge will be to understand decision processes and to facilitate a synergy between technology and the people using that technology. This understanding will come

about through research and cooperation between those that supply the services and those that use those services.

BIBLIOGRAPHY

1. Henderson, J., "Finding Synergy between Decision Support Systems and Expert Systems Research", Decision Sciences, Vol 18, 1987.

2. Kraemer, K. and King, J., "Computer-Based Systems for Cooperative Work and Group Decision Making", ACM Computing Surveys, Vol 20, 1988.

3. Rockart, J. and DeLong, D., "Executive Support Systems", Dow Jones-Irwin, 1988.

4. Treacy, M., "Future Directions in DSS Technology", MIT Working Paper #123, 1985.

5. Vogel, D. and Nunamaker, J., "Group Decision Support Systems: Determinants of Success", University of Arizonia, 1987.